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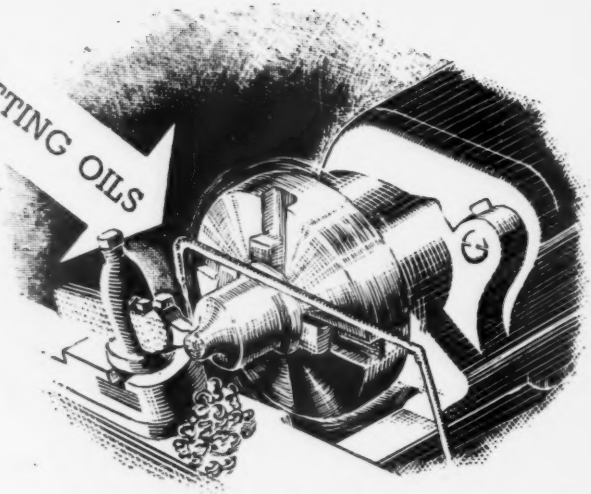

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INTERNATIONAL TRADING PROBLEMS AND THE OIL INDUSTRY*

By P. M. DE VEULLE (Member) and O. F. THOMPSON (Fellow).

This paper aims to provide a background that will be of assistance in understanding the problems with which the oil industry is confronted. A brief analysis is given of present-day trading conditions with particular reference to the position of the international oil industry. An indication is also given of the extent and nature of the future demand for oil and problems associated with the industry's plans for capital expansion. The effect of monetary exchange difficulties on the industry's plans is also discussed.

The Background

The international trading scene to-day bears little resemblance to the situation which prevailed during the period of trade expansion from the latter half of the nineteenth century up to 1914. Commerce was then conducted on the principle that it was best if each individual trader were free, within limits, to conduct his business in his own way. This period saw the development of the multilateral system of trading in which payment of goods and services supplied by a trader in country "A" to a merchant in country "B" could be effected by using currency earned in country "C". There was little, if any, recognition of the problem of equating payments with receipts, for it was known that, in the last resort movements in exchange rates

* Paper read before the London Branch of the Institute on March 22, 1949.

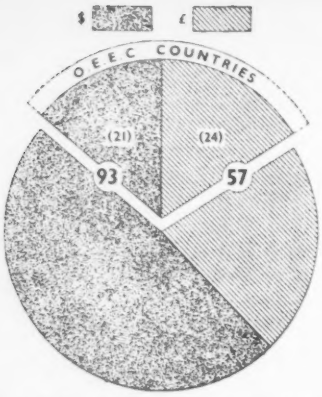


Fig. 1. Dollar and sterling oil in international trade 1948 (million metric tons).

and possible payment in gold would restore equilibrium.

The year 1914 marked the beginning of the disintegration of this system. The last 35 years have seen two wars waged on an unprecedented scale and two major economic crises. The second of these crises induced many countries of the world to pursue highly protectionist policies in vain attempts to insulate their economies from the worst of world economic conditions.

Economic development implicit in these autarkic-seeking policies has created new needs and intensified the desire for higher standards of living which can only be achieved by the continuance of international trading and investment at a high level. The needs exist but, as a consequence of the recent war, many countries are incapable of earning enough foreign exchange from exports to enable them to import the goods required to satisfy these needs.

The dollar shortage is a symptom, and an important symptom, of this affliction, the cure for which requires primarily the speedy solution of the dollar problem. The sooner the European Recovery Programme achieves its objectives the sooner it will be possible for international trading and investment to be freed from the controls which now restrict them.

International Character of the Oil Industry

The international ramifications of the major oil companies are so widespread that difficulties in international trading inevitably affect the efficient operation of the industry. It is only necessary to point out that some of these concerns direct their activities from one country, conduct their production operations in another and their refining operations in the same or in another country, and sell their products in yet other countries, to appreciate that such operations would be very much easier if we were living in a more unified world. It is also a fact that, while petroleum is produced in some 20 countries, the international oil trade is conducted almost entirely in oil produced by U.S., British, and British-Dutch concerns. Generally speaking, oil produced and sold by U.S. concerns anywhere can be termed "dollar oil"; oil produced can sold with the aid of British and British-Dutch resources anywhere can be termed "sterling oil" and practically the whole of the international petroleum trade is now carried on in one or other of these two currencies (Fig. 1). This is a matter of considerable significance in the light of the current shortage of dollars.

Moreover, the fact that the international petroleum industry is highly integrated means that the greater part of the oil trade is conducted on a "direct supply" basis which involves a direct relationship between the supplier and the consumer. As a result, the needs of many countries, which invariably differ widely from product to product, can be aggregated and knitted together, so that the raw material, crude oil, can be most advantageously used. It is, therefore, a well-planned industry.

Insignificant in international trade

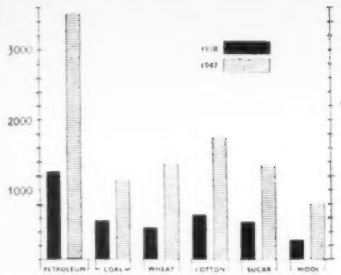


Fig. 2. Value of world petroleum exports compared with some other commodities (million U.S. dollars).

50 years ago, petroleum products are now the most important item, both in terms of volume and of value, in the world's international trade (Figs. 2 and 3). More than 150 million tons moved in international trade in 1948, more than twice the volume of foodstuffs.

Against this brief background to the industry's position in international trade, let us now consider the outlook for the future. What are the main problems that lie ahead? These can be considered under the following headings:

(*a*) *The prospect for a great expansion in demand.*

(*b*) *The need to provide a vast amount of capital and equipment.*

(*c*) *The balance of payments problem.*

These three aspects are, of course, interrelated but, for convenience, they can be considered separately.

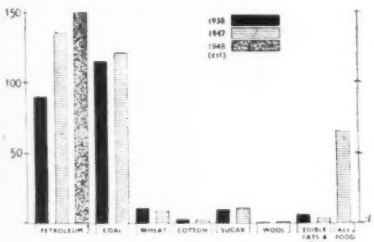


Fig. 3. Volume of world petroleum exports compared with some other commodities (million metric tons).

The Oil Industry's New Horizons

One of the most striking phenomena of the present age is the insatiable demand for energy; no country has enough and this demand seems to be almost statistically limitless. The relative part played by oil in meeting this demand has been constantly growing (Fig. 4). According to all indications oil will provide a much larger proportion of the world's energy supplies in the decades that lie ahead.

Detailed statistics of the numbers of consuming units that might be expected to be in use during the next few years give some indication of the demands that may be made upon the industry in the near future. The Organization for European Economic Co-operation has been devoting much time to the petroleum needs of the Marshall countries,

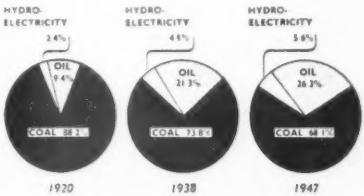


Fig. 4. Sources of world energy supply.

and it is interesting that these needs, which are a conservative estimate of essential requirements, call for 30 per cent more oil in 1953 than is being consumed at the present time (Fig. 5). While the estimated demand varies quite considerably as between the different countries of the world, the European requirements are a fairly good index of the increase in demand that may be expected from the rest of the world, exclusive of North America. In the case of the U.S., which is at present consuming 59 per cent of the world's supplies, the demand is not likely to increase percentagewise so rapidly as elsewhere, although the consensus of opinion is that the absolute increase in

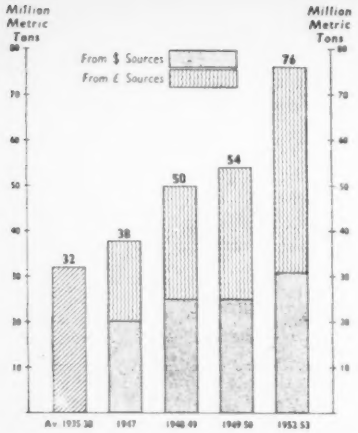


Fig. 5. Estimated imports of petroleum by O.E.E.C. countries.

potential U.S. demand must be expected to be substantial.

Demand possibilities in the more distant future are less clear but it is interesting to note that if economic development in relatively underdeveloped countries should ever approach the level attained in the United States at the present time, the *per capita* demand for petroleum products could conceivably be multiplied as much as one hundred times or more. The potential is great and we must be prepared for some surprises.

Capital Requirements

In a recent White Paper it was stated that "the programme of the British oil companies is vast". Britain is not alone in having a vast expansion programme. Without going into figures the annual average capital expenditure by the world petroleum industry (exclusive of the Russian sphere of influence) is not only substantially in excess of the total defence expenditure of the U.K. for 1948, but it is also equivalent to about 58 per cent of the total dollar funds granted for European recovery. The provision of the enormous amount of capital required is a problem of some magnitude and it is as well to have some idea of what those needs are and how they can be met.

In addition to the fact that the industry deals in a commodity the demand for which is steadily increasing, a large part of its capital is in oil wells which are a wasting asset. Moreover, the technical character of the industry imposes high rates of obsolescence and renewal. It is significant that for industry as a whole, about two-thirds of capital expenditure is for replacement and about one-third for expansion. For the oil industry the proportion is about half and half. The need for a continuous supply of new capital is therefore apparent.

To give some idea of this need the capital expenditure of the oil industry in America in the four years from 1947 is likely to be at least $7500 million. Outside America there are such projects as the proposed pipelines from the Persian Gulf to the Mediterranean, each of them waist-high to a man. These are expected to cost something like £50 million apiece and each will save the construction of about eighty-five 16,000-ton tankers.

The Sterling Oil Companies' Capital Requirements

Work has now begun in the expansion of the U.K. refining industry which, under the current programme, will have an annual capacity of 20 million tons by 1952–53. The programme will cost no less than £125 million of which between £25 and £30 million will be incurred during 1949–50. Although the major part of the cost of extending U.K. refineries will be borne by the sterling oil companies, they have also undertaken substantial expenditure on producing, refining, and transportation facilities overseas. A recent White Paper estimates that this expenditure,

during the current year alone, will involve about £100 million. The sterling companies, for example, have launched from British yards at least 60 ocean-going tankers since the end of the war and have a further 56 building in the U.K. These include a number of giant 28,000 tonners, each costing to the order of a million pounds.

This question of capital is of key importance for our industry and one which has important current implications. Too often we think of capital as being merely money. In reality, money capital represents claims to goods in one form or another and, when we speak of capital investment overseas by the oil industry, we must think not only of money which is paid out in wages and other local expenditure on capital projects but also in terms of machinery and equipment of all kinds for oilfields, refineries and terminals, pipelines, and transport and distribution facilities.

Oil companies as a whole have always provided a major part of their capital expenditures from internal funds, namely the cash generated out of their operations. For instance in 1948 something like 90 per cent of the capital expended by 30 U.S. oil companies came from internal funds.

The Factor of Profits

This brings up the question of profits. Earnings in the past two years have been not only at levels unparalleled in the history of the industry, but the net profits of certain large companies in the U.K. and in America have been at a scale far in excess of the largest corporation earnings hitherto recorded. The American petroleum economist, Pogue, has analyzed the two aspects of these earnings that need to be borne in mind. The first is that these earnings have been obtained in to-day's inflationary conditions. As a single instance, a tanker to-day costs two and three quarter times what it cost before the war. If these earnings are expressed in terms of values in existence when the capital was subscribed, the rate of return for thirty American oil companies in 1947 would have been only equal to 7·7 per cent. The other aspect is the enormous cost, again due to inflation, of providing the new facilities needed to meet current demands.

Pogue has aptly summed this situation up by comparing "profits" with the motive power of a trans-continental train. On the plains, one locomotive is sufficient. On the long up-grade in the mountains, two are required. And when the divide is passed, the second locomotive is dropped. Supply and demand correspond to the terrain. Inflation throws supply and demand badly out of balance and creates difficult country to be traversed. Inflation has imposed a steep up-grade during the past two years and "profits", the motive power, have been called upon to do an almost impossible job.

Restrictive Taxation

Industry has recently been voicing growing concern at the long-term effect of taxation of company earnings. Such taxation inevitably places a check upon the formation of new capital and the incidence of this taxation is particularly felt by the oil industry with its need for a continuous supply of new money. There is also the taxation of products. In many countries oil products, and particularly gasoline, are now regarded as a tax carrier in the same way as tobacco and spirits. Such taxation tends to ignore the vital character of cheap motor transport as a basic factor in a modern economy.

The Industry's Foreign Currency Requirements

In the case of the sterling companies these expansion programmes involve the installation of great quantities of equipment overseas. The shipment of

materials from the U.K. is subject to all the priority and licensing regulations affecting steel and other scarce materials, and the government must necessarily be satisfied that these exports of capital goods will be used for the long-term advantage of the exporting country. These advantages are, firstly, the supply of sterling oil to the U.K. and, secondly, the earnings arising from the sale of oil to other countries (Fig. 6).

The shipment of oil equipment from the U.K. is only a part of the story, but for Britain it is an important part,

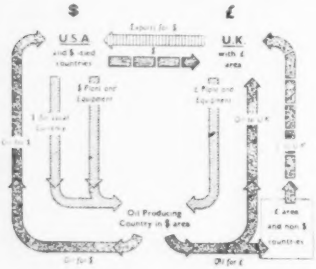


Fig. 6. Dollar and sterling movements relating to "sterling" oil produced in a dollar-tied area.

because in this way goods to the value of £50 to £60 million a year are sent overseas for oil production, refining, and transportation. The petroleum industry is, however, so highly specialized in its operations that many items of equipment can only be purchased in the U.S.A.

For the sterling oil companies this means expenditure in dollars and sterling oil must therefore of necessity have a dollar element in it.

The Balance of Payments Problem

The complications arising from the inconvertibility of sterling and from the shortage of dollars serve to emphasize the overriding importance of what is called "Payments problem". As compared with the relatively free trading systems of the past such considerations as relative terms of trade, price levels, direction of exports, and currency availability predominate over what ought to be the very simple task of satisfying each other's needs. In the last resort, the modern problem of payments arises from a lack of balance between particular countries' needs for imports and their ability to supply acceptable goods in exchange. This state of unbalance has been greatly accentuated by the position of the U.S.A. There are three principal causes of dollar exchange shortage. Firstly, the war has resulted in an increased dependence upon the Western hemisphere as a source of supply. Secondly, the terms of trade have moved against the importer of dollar goods, the inflation in the States having a disastrous effect. Thirdly, the U.S. does not need imports to the same extent as other countries need her exports.

The Position of Sterling

Before discussing the effect of the currency situation upon the oil industry, it is necessary to have some understanding of the effect of this situation in regard to the use of sterling in international trade. Sterling is already the currency used over a large section of international trade. As Britain furthers her export drive the volume of sterling, including blocked sterling, in the hands of many holders all over the world will ensure its quick return as a world-wide trading currency. At the present time the world is divided up into four main regions towards each of which the sterling area has a different set of financial relationships.

The sterling area itself comprises all the countries of the Commonwealth except Canada, and includes Burma, Iceland, and Iraq. Within that area, sterling is generally freely transferable and all the countries in the sterling area (with South Africa a special case) pool their dollar earnings and receipts for the common good of the area as a whole.

This is a remarkable measure of economic co-operation within the Commonwealth, characteristic perhaps of the new kind of links which are being forged.

The dollar area covers North and Central America and one or two countries of South America, and in this area transfers of currently earned sterling are free.

The third grouping is the "Transferable Account" countries. This grouping of countries is important from the oil industry's standpoint, since it includes the Dutch monetary area and Iran. Each country within this group has separate payments agreements with the U.K. governing the use of sterling funds. Currently earned sterling (distinct from funds accumulated during the war) may be transferred between members of this group without reference to the U.K. It is, in a way, a "little sterling area".

The fourth grouping may be termed "Bilateral Countries", and covers many important trading countries in Europe and elsewhere. The payments agreements with these countries are more closely bound with the volume of trade between each country and the U.K. and each party usually agrees to hold each other's currency up to a certain amount. If trade is unbalanced beyond this amount, one side or the other would restrict trade within the bounds of the agreement, failing which gold or its equivalent must be paid. There is often a trade agreement complementary to the payments agreement laying down what imports and exports shall pass between the countries during a given period. Petroleum products sometimes appear in this catalogue of goods and this may involve a considerable adjustment of normal trade. Throughout this group of countries the volume of petroleum imports is liable to be influenced less by needs than by available currency.

As far as influence upon international payment is concerned, sales of sterling oil have the same effect as exports of goods from the U.K. The expanding demand for oil, and for sterling oil, is therefore a very favourable long-term trading factor for the U.K. The essential counterpart to high production, however, is that Britain and other sterling countries should be large importers as well as exporters, and in this way maintain and stimulate the sterling purchasing capacity of other countries. In principle the oil industry cannot but welcome a return to multilateral trading. An abundance of sterling oil can play an important part in extending the free convertibility of sterling.

The Marshall Plan

There is no doubt that shortages of foreign exchange would have resulted in a disastrous breakdown of international trade, but for the fact that, including Marshall Aid, the U.S. Government has extended no less than $20,000 million in loans and grants since the end of the war.

In discussing the effect of the Marshall Plan on the international oil industry, there are certain fairly simple, yet fundamental, considerations which need to be understood, and which seem to have attracted relatively little notice in the course of all the publicity concerning the Economic Co-operation Administration and its counterpart in Paris, the Organization for European Economic Co-operation.

The Marshall Plan aims to make the participating countries independent of further dollar grants or loans. Yet we must face the fact that at the end of the Marshall period, the majority of the participating countries are likely to be still heavily dependent upon dollar oil, dollar cereals, and dollar cotton, to name the most important.

The Threatened Distortion of the Economic Pattern of Trade

Bearing in mind that a substantial increase in oil consumption will be an

essential factor in increasing the industrial output of Europe, the problem presented by Europe's reliance upon dollar oil is, indeed, a formidable one: what can be done about it? Perhaps the first thought that may spring to mind is to increase greatly the output of non-dollar oil and reduce purchases of dollar oil to that extent. However, such a policy could have serious consequences. It would involve, in the first place, a dislocation of the international oil industry. Expressed in its broadest terms, to put a dollar company in Europe out of business would not only be biting the hand that feeds us, but would also result in a disruption of the pattern of trade which would be exceedingly costly, and entirely uneconomic. Moreover, if the flow of dollar oil to Europe was stemmed in this way, this oil might seek outlets in other directions and threaten the disruption of those markets in other parts of the world in which the sterling companies have an important interest. It remains to be seen how this perplexing problem will be resolved.

The Economics of New Refineries

One consequence of the shortage of exchange is that it is stimulating countries to import crude oil which is cheaper than finished products. More countries are now considering the possibility of establishing a refining industry. These prospective refineries, in total, add up to more refining capacity than appears likely to be needed in the immediate future. Thus there is a serious risk that this temporary stringency of foreign exchange may leave a legacy, a refining capacity, which may not all be economically justified and which may not be commercially profitable unless buttressed by State protection in one form or another. Incidentally, the recent sharp reduction in the price of oil products has greatly restricted the refining profit margin and many of these schemes now appear to be, commercially, less attractive than may have previously been the case.

Restrictive Tendencies of Economic Nationalism

This question of uneconomic refineries brings to the fore the problems arising from economic nationalism. In many countries to-day increasing limitations are being placed upon the activities of international trading concerns. One country decides to exclude foreign capital from operating concessions while another, for example, encourages the erection of local refineries to the exclusion of foreign marketers, although economic nationalism when manifested in this particular way will unquestionably prove expensive to the ultimate consumer.

There is a great need to think back to first principles in the international exchange of goods and to try and break away from the tangle of defensive measures and restrictions which impede the satisfaction of each other's wants. Fortunately, the attitude of most leading countries towards the complex problems of international trade is, within limits, a constructive one. We have seen such far-sighted innovations as UNRAA, Marshall Aid, the International Monetary Fund, and the International Bank for Reconstruction and Development. More recently there has been the Havana Charter of the International Trade Organization and while it remains to be seen to what extent this Charter, if ratified, may help to encourage multilateral trading, it at least aims to bring about a new era in international relationships. When all is said and done, our greatest problem in international affairs is the age-long human problem of being "good neighbours".

SIGNIFICANCE OF PROPERTIES OF PETROLEUM PRODUCTS

III. VOLATILITY

By E. B. EVANS (Fellow)

AN old and well-known system of classification divides oils into two classes —those which are "fixed" and those which are "volatile". The "fixed" oils include the animal and vegetable fats, oils, and waxes which are esters of fatty acids and alcohols; in the case of most fats and oils the alcohol present is glycerol. They cannot be volatilized or distilled without decomposition, except under very high vacua. The "volatile" oils comprise the hydrocarbon oils derived from coal tar, shale, and petroleum, and various oils from plants ("essential oils"). Except for the very heaviest fractions, such as asphaltic residues and petroleum coke, practically all petroleum products are volatile under suitable conditions, although some of the heavier products can be distilled only under high vacuum; those constituents which are not volatile, such as the asphaltenes, contain elements such as oxygen or sulphur, in addition to carbon and hydrogen.

Volatility may be defined as the tendency for molecules of a substance to escape from the liquid into the surrounding atmosphere. This tendency becomes greater as the temperature of the liquid increases. On the other hand, the higher the pressure above the liquid the more difficult it is for molecules to escape from the liquid. The temperature at which the molecules leave the liquid so freely as to build up a pressure equal to the atmospheric pressure, is the "boiling point" and this temperature must be stated in regard to the pressure at which it is determined. Thus, at low pressures, e.g., 1, 10 or 50 mm mercury, the boiling point is much lower than the boiling point at the normal atmospheric pressure of 760 mm mercury. At high altitudes (where the atmospheric pressure is low) water will boil at a temperature much lower than 100° C; or gasoline may boil in aircraft tanks. The vapour pressure of a pure liquid at a particular temperature is, therefore, the pressure which must be maintained in the vapour space so that the liquid will just boil continuously. In other words, it is the pressure at which the pure liquid is in equilibrium with its pure vapour at the given temperature.

These remarks on boiling point and vapour pressure apply to pure compounds. Petroleum products in general are complex mixtures of hydrocarbons and as such have no definite boiling point but instead a "boiling range". On heating, the lower boiling constituents vaporize most freely at the lowest temperature and as these are removed and the temperature of the liquid increases, hydrocarbons of progressively higher boiling point leave the liquid. As the numerous hydrocarbons in the product, for example a gasoline, all exert some vapour pressure, molecules of each of them will be present in the vapour immediately above the liquid. The proportions, however, will be different and the lower boiling compounds will be present in the vapour in a higher concentration than in the liquid. In a simple distillation where the liquid is boiled in a flask and the vapour led off directly through the side-arm into a condenser, the degree of separation of the components is not very high. This is particularly so if the rate of distillation is great and there is little chance of equilibrium being attained between the liquid and its vapour.

Much better separation, and even isolation of constituent hydrocarbons

in a pure state, can be achieved if a sufficiently good "fractionating column" is included in the distillation apparatus. In this, partial condensation of the vapour occurs and a series of "equilibria" are established up the column so that the composition of the vapour changes as it passes up, the effect being that of innumerable small distillations each resulting in a vapour and liquid residue differing slightly in composition.

Distillation Tests

The distillation tests which are applied to petroleum products for routine examination purposes do not usually involve a high degree of separation of the constituents. The I.P. "Standard Methods for Testing Petroleum and its Products" lists seven methods for distillation tests. Those for motor fuel, kerosine, and similar products (I.P. 28/42: A.S.T.M. D.86–40) and for natural gasoline (I.P. 29/42: A.S.T.M. D.216–40) are very similar and consist in distilling the product from a glass flask fitted with a thermometer, the vapours being condensed in a brass condenser from which the liquid flows into a measuring cylinder. The percentage of distillate recovered at specified vapour temperatures is recorded during the test, together with the "initial" and "final boiling-points", the volume of the residue, and the evaporation loss. The differences in apparatus and procedure for the various products are not great and consist, for example, in the use of a higher range thermometer for kerosines, the use of ice-water in the condenser for gasolines and light solvents, and the special cooling of the receiver for natural gasoline. As mentioned previously, the degree of separation obtained during distillation in such an apparatus is not high and the results are very dependent on the details of the apparatus, the rate of distillation, etc. For this reason the dimensions of the apparatus (including flask, thermometer and condenser) must be very carefully standardized and the laid-down procedure must be rigorously followed if repeatable results are to be obtained.

Gas and diesel oils are distilled in a very similar apparatus and manner (I.P. 26/42), one of the main differences being that 250 ml are taken for distillation instead of the 100 ml used for gasoline and similar products. Cut-back bitumens are distilled (Method I.P. 27/48: A.S.T.M. D.402–36) to separate and estimate the proportions of bitumen and volatile constituents present and to enable the properties of the distillate and residue to be examined. For the distillation of heavy residues, distillation under vacuum is necessary and Method I.P. 74/44 describes such a method, using a pressure of 10 mm Hg.

For the examination of crude petroleum to estimate the yields of products obtainable, a number of methods are available. Two such methods are described in "Standard Methods", one (I.P. 24/44) a simple test intended for preliminary examination, and the other (I.P. 25/44), a test involving more elaborate fractionating equipment and giving more detailed information on the crude. In the latter, and many similar methods such as "true-boiling analysis", larger amounts of charge are distilled so that there are sufficient volumes of the distillation products for these to be examined in some detail.

Vapour Pressure

The vapour-pressure of light petroleum products, such as natural gasoline, and motor and aviation fuels, is usually determined at a temperature of 100° F in the Reid apparatus (I.P. 69/45: A.S.T.M. D.323–43). The pressure developed when the gasoline is admitted to a metal vessel containing air and raised to 100° F is measured and a correction applied for the pressure

increase due to raising the temperature of the air and water vapour present.

Loss on Heating

Some oils and heavier petroleum products contain relatively small amounts of constituents of higher volatility than the rest of the material. The amounts of these volatile constituents are estimated by carrying out "loss on heating" tests in which the oil is heated in shallow dishes for a specified time and under specified conditions and the loss determined. Such tests are I.P. 45/42 for bitumen and I.P. 46/42 for transformer oils.

Volatility is one of the most important properties of petroleum products and affects, in some way or another, the uses and performance of all of them. In the first place partial volatilization and the formation of a vapour which may form an explosive mixture with air controls the inflammability of oils. The various flash-point tests are therefore tests for the volatility of products and, in general, the greater the volatility the lower will be the flash-point and the ease of formation of inflammable or explosive vapour-air mixtures.

Gasoline Volatility

The use of gasoline depends on its ability to vaporize readily on carburation and give an explosive mixture with air which will burn in the engine cylinder. Within certain limits more volatile fuels give better results in the gasoline engine. Ease of starting, for example, is governed by the proportion of low-boiling constituents present and the higher the proportion of these the more readily an explosive mixture will be formed in the cylinders to enable the engine to fire. Similarly, the more volatile the fuel the more rapidly the engine warms up and the sooner the use of the "choke" can be dispensed with. As a measure of startability and warm-up rate the 10 per cent and 35 per cent evaporated temperatures in the standard distillation test are used, or sometimes the percentages distilling at 70° C and 100° C. Once the engine is warmed up, its acceleration performance is dependent on the overall volatility of the fuel and as a measure of this aspect of performance either the 65 per cent evaporated temperature or the percentage distilling at 140° C in the standard distillation test is often used. Large amounts of high-boiling material ("heavy ends") in the fuel result in too much unvaporized fuel entering the cylinders and mixing with the lubricating oil on the cylinder walls resulting in dilution of the oil to an undesirable extent. For this reason the 90 per cent distillation point of a gasoline should not be too high. Although ease of starting is improved by the inclusion of low-boiling hydrocarbons in gasoline, the proportions of such compounds should not be too great. There is a close relationship between the amount of gasoline distilling at low temperatures and the Reid vapour pressure, the best correlation being between the temperature at which 10 per cent of the gasoline is evaporated and the vapour-pressure, providing that the gasoline is substantially free from propane which exerts a very high vapour-pressure. Vapour-pressure is determined on gasolines as a control on the tendency to "vapour-lock", that is of the liability of vapour forming in the fuel lines, pump, or carburettor so that the flow of fuel to the engine is interrupted and the engine stalls. For this reason, gasoline specifications usually contain a figure for maximum allowable vapour pressure.

Volatility of Solvents

The volatility of solvents such as special boiling-point spirits and white spirits is one of their most important properties and the boiling range of such products is very carefully controlled. Sometimes the boiling range is very narrow, say 10° C, 20° C, or even less. In the manufacture of glue, for example,

it is essential to be able to remove the last traces of solvent without using too high temperatures; in consequence, "heavy ends" must be avoided in solvents used for this and similar industrial purposes. For other applications the evaporation rate of the solvent is of great importance over the whole range. Such a case is the use of hydrocarbon solvents as "diluents" in cellulose lacquer formulation, where a mixture of esters, alcohols, and other solvents may be used. If the solvent evaporates too rapidly, "blistering" of the lacquer occurs, while if the heavier fractions evaporate too slowly "blushing" or precipitation of the cellulose in opaque, non-adhesive layers will result. Similar importance attaches to the volatility of solvents in most of their industrial uses, particularly where a balance must be achieved between too ready evaporation with consequent heavy losses on one hand, and the necessity for complete final removal of the solvent on the other. Hydrocarbon solvents such as special boiling-point spirits and white spirits are tested for volatility not only by the usual distillation test used for gasoline, but also by special tests which measure the rate of evaporation of the product when it is allowed to volatilize under prescribed conditions such as, for instance, exposure in an open flat dish or on a filter paper. Many such tests have been described and have their special application.

Kerosine Volatility

In the combustion of fuels it is, in general, the vapour, not the liquid itself, which burns when mixed with air. Thus, in the case of kerosines used in the common wick-type of equipment, the fuel vaporizes from the top of the wick and burns above it. The boiling range of the fuel, and particularly the proportions of low-boiling material or of heavy ends contained in it, affect the flame size and its stability. The viscosity of conventional burning kerosine is largely controlled by the mid-boiling-point and affects the flow of oil up the wick. In the vaporizing type of burner (e.g., the Primus type) front-end volatility is important in regard to the starting and general performance of the equipment. Flash-point (discussed on pages 194–6*) and front-end volatility are very closely connected, and for safety reasons, therefore, the boiling-range of a kerosine must be controlled so that ease of starting must not be achieved at the expense of reducing flash-points to dangerous limits.

Gas Oil and Fuel Oil

In the diesel engine, fuel is injected at high pressure in the form of fine droplets into heated air. Evaporation takes place from the surface of the drops and ignites in the heated atmosphere. The volatility, and hence the rate of evaporation of the fuel, has an important bearing on the ignition characteristics and on such effects as exhaust smoking. Gas oils, when used for washing benzole from coal gas, should not contain too large proportions of the more volatile constituents, since these will be removed during steam distillation to recover the benzole, and result in a loss of wash oil.

Fuel oils, burned under atmospheric pressure under boilers, are also atomized into fine droplets and partial evaporation occurs in this case also, the volatility affecting the burning characteristics. Small quantities of lower-boiling constituents which may be present influence the possibility of explosion under certain conditions of storage and use, and an "explosivity" test is included in some fuel oil specifications.

Lubricating Oils

Flash-point, rather than distillation, is generally used as an indication of the volatility of lubricating oils. It is probable that volatility, as well as viscosity

* *J.P. Review*, July 1949.

at the working temperature, has an influence on the consumption of oil in an internal combustion engine. The amounts of heavier fractions, e.g., bright stocks, present in a motor oil may also affect the lubrication and wear properties in conditions where the temperature is high enough to cause lower-boiling material to evaporate. Similarly when lubricating steam engines working with considerable superheat, it is desirable to use a heavy non-volatile oil of the "steam cylinder" type in order to maintain a lubricating film. Carbon residue tests (particularly the Ramsbottom test —I.P. 14/45) give a measure of the non-volatile, easily carbonizable material present in a lubricating oil. For certain purposes, e.g., in high vacuum technique, lubricants of very low vapour-pressure are necessary. These, the so-called "apiezon oils" are obtained by a process of "molecular distillation". In this method a thin film of oil is heated at a very low pressure, e.g., 0·001 mm Hg. with a cooled surface near by. Distillation of very high-boiling fractions can be accomplished in this way and the products have extremely small vapour-pressures at ordinary temperatures.

Bitumens are, in general, non-volatile products, but small amounts of lighter constituents may be estimated by the "loss on heating" test (I.P. 45/42). The result gives some indication of the changes in properties which may occur during application and use of such products.

Suggestions for Further Reading

The very brief review which has been made of the large subject of volatility of petroleum products, touches only very lightly on the significance of this property, and on the various ways in which it is evaluated for different products. Apart from the I.P. "Standard Methods" and the A.S.T.M. Standards, which describe the accepted methods of testing, there are a number of other sources of information which should be consulted for further information on volatility in relation to the properties of petroleum products. These sources, a few of which are mentioned below, deal mainly with the lighter petroleum distillates.

G. C. Brown, "The volatility of motor fuels", Engineering Research Bulletin No. 14, 1930. University of Michigan.

C. R. C. Handbook, 1946 Edn. "Volatility of motor and aviation fuels", pp. 114 and 195.

W. A. Whatmough, "The startability of motor fuels", *Auto Eng*, 1933, **23**, 371.

A. W. Nash and D. A. Howes, "The principles of motor fuel preparation and application", Chapman & Hall, 1935.

G. Edgar, J. B. Hill and T. A. Boyd, "The meaning of the gasoline distillation curve", *Proc. Amer. Petrol. Inst.*, 11th Annual Meeting, 1930, Section III, 46.

"Modern Petroleum Technology", Institute of Petroleum, 1946. Various articles, e.g., p. 220, "Motor fuels", E. B. Evans, p. 245, "Aviation gasoline", Maxwell Smith.

F. N. Harrap and E. B. Evans, "Hydrocarbon solvents from petroleum and their industrial application", *J. Inst. Petrol.*, 1941, **27**, 369.

"The Science of Petroleum", Oxford University Press, 1938. Various articles, e.g., p. 2594, "Apiezon oils", C. R. Burch.

THE CHEMICAL ENGINEER

In a recent issue we referred to a definition of a chemical engineer which was given in an after dinner speech. The definition is reproduced below:

> "A chemical engineer is a person who passes as an exacting expert, on the basis of being able to calculate on a slide rule afflicted with stick-slip, infinite strings of incomprehensible formulae, with Greek symbols whose powers are unknown, from vague assumptions, which are based on debatable figures taken from inconclusive experiments, carried out with instruments with problematical accuracy, by persons of doubtful reliability and questionable mentality."

COURSES IN PETROLEUM TECHNOLOGY

DETAILS which are available of courses in petroleum technology and allied subjects are summarized below:

SIR JOHN CASS TECHNICAL INSTITUTE

This General petroleum technology course of nineteen afternoon (2.45 p.m.) lectures on Thursdays from October 6, 1949, to March 16, 1950, and two refinery visits, follows similar lines to previous winter courses at the Cass Institute.

October 6. Introduction. Origin of petroleum and types of products. L. W. G. Firmin.
Oct. 13. Winning and principles of fractionation. P. F. Ellis.
Oct. 20. Combustion. Uses of gases. L. W. G. Firmin.
Oct. 27. Principle of the spark ignition engine. L. W. G. Firmin.
Nov. 3. Gasoline testing. L. W. G. Firmin.
Nov. 10. Gasoline production. L. W. G. Firmin.
Nov. 17. Uses of kerosine, white spirit, etc. P. F. Ellis.
Dec. 1. Principle of the compression ignition engine. L. W. G. Firmin.
Dec. 8. Fuel oil applications. S. A. Hunn.
Dec. 15. Lubricating oil applications. P. F. Ellis.
Jan 12. Manufacture and testing of lubricating oils. E. J. Boorman.
Jan. 19. Development of lubricants. E. J. Boorman.
Jan. 26. Manufacture, testing, and use of greases. E. J. Boorman.
Feb. 2. Paraffin wax refining and uses. E. J. Boorman.
Feb. 9. Manufacture, testing, and use of bituminous products. S. A. Hunn.
Feb. 16. Special products. L. W. G. Firmin.
Feb. 23. Storage. S. A. Hunn.
March 2. Measurement and transport. S. A. Hunn.
March 16. Research and development. P. F. Ellis.

Fee for the course is 30*s*, and details are obtainable from the Principal, Jewry Street, Aldgate, London, E.C.3.

ACTON TECHNICAL COLLEGE

A course of twelve lectures will be given on Fridays at 7.30 p.m. from September 23 to December 9. It will consist of lectures on analysis of fats and fat-containing materials (*Sept. 23 to Oct. 7*), micro-analysis applied to oils and fats (*Oct. 14 and 21*), synthetic fatty acids and fats (*Oct. 28 and Nov. 4*), drying oils (*Nov. 11 and 18*), and biochemistry of fats (*Nov. 25* and *Dec. 9*). Particulars are obtainable from the Principal, Acton Technical College, High Street, London, W.3.

BATTERSEA POLYTECHNIC

Two evening courses are of interest. The first is that in chemical engineering designed to prepare students for the A.M.I.Chem.E. examination and entailing attendance on two evenings per week for two years. The second is in chemistry for the internal B.Sc. (Special) degree and the A.R.I.C.

Details are available from the Principal, Battersea Polytechnic, London, S.W.11.

NORTHAMPTON POLYTECHNIC

A series of 21 lectures on Recent trends in Fuel Technology commences at the Northampton Polytechnic (*St. John Street, London, E.C.1*) October 4 at 7 p.m. Included in the course are lectures on the Fischer-Tropsch Process, by S. R. Craxford (*October 4*); the Phenomena of Combustion, Flame, and Explosion, by G. Wittingham (*November 15 and 22*); Liquid Fuels, their Characteristics and Utilization, by G. F. G. Murray (*November 29, December 6 and 13*). Course fee is 30*s*, and enrolment is by post or at the Polytechnic office between 10 a.m. and 7 p.m.

COUNCIL COMMENTARY

THERE was a fair attendance at the Council Meeting held on July 13, and in the unavoidable absence of the President, who was attending an Oil Consumers' Council meeting, Dr E. B. Evans was elected to the Chair.

After minor corrections, the Minutes of the June Meeting were passed and signed and various matters rising from them were dealt with, including a letter of thanks from a grateful member who had been allowed adjustments of his subscription owing to ill-fortune.

The General Secretary reported on his contact with the Institute of Fuel in connexion with a suggested offer of hospitality to delegates to the World Power Conference. It was decided to welcome visitors from the Conference at Manson House and to put our library at the disposal of the delegates.

Mr Hyams was able to report on a most successful Conference at Brussels which had been attended by delegates from sixteen countries including the U.S.A., and which had unanimously agreed to the proposal that the A.S.T.M. and the I.P. should go ahead with the joint production of British, American, and metric tables of oil measurement.

The Election Committee, through Mr M. A. L. Banks, presented a list of names of candidates recommended for election which was approved.

A list of members in arrears with subscriptions was also brought forward by Mr Banks, but was not circulated at this stage. It was decided that the General Secretary should make a personal appeal to each one and that the list of those still outstanding on September 1 should be considered at the Council Meeting in September. Should this catch the eye of any unwitting culprit, let him act quickly!

Mr Thornton made further comment on the situation concerning the City and Guilds examination in petroleum and stressed the value to the industry of the younger and new members having such general, all-round knowledge of petroleum technology as would be conferred by the studying for and the passing of such an examination.

Dr E. B. Evans presented a report of Publications Committee indicating encouraging support for and satisfactory progress with arrangements for the Oil Shale and Cannel Coal Conference to be held in Scotland next year.

Mr E. J. Sturgess drew attention to the desirability of giving every opportunity to Member-Companies to take part in Institute activities such as the presenting of papers and contributing to literature. This suggestion met with general approval and was noted by Dr Evans for future use.

Considerable time was expended on the discussion of a "bombshell" notification from the Income Tax Authorities that we were no longer exempt from income tax. We appear to have been singled out for attack and means of defence were approved to safeguard our non-existent profits from such attack! The point, however, is not entirely hypothetical since certain of our activities in connexion with research might be seriously affected if funds were made taxable and as the trouble appears to rise from wording of by-laws, it should be capable of solution in due course.

Mr H. Hyams again dealt with the financial position, which was seriously affected by the arrears of subscriptions, and stressed the desirability of all subscriptions, large and small, being paid promptly.

Branches Committee Report No. 23 was presented by Mr G. H. Thornley and discussed, other reports being deferred to the next meeting.

A Committee consisting of present and past presidents and vice-presidents together with the Honorary Secretary was appointed to make recommendations for the next president.

The President reported through the General Secretary that the Paris Conference of the Association Française des Techniciens du Pétrole had been a great success from both the technical and social aspects.

This concluded the proceedings.

The next Council Meeting will be held in September.

ALBERTA OIL SANDS

In its report for the year 1948 the Research Council of Alberta states that one finding of particular interest which emanated from the study of the oil sands, is that the oil in the southern part of the deposit is very viscous and that the oil becomes progressively more fluid northward. Near McMurray, for instance, the bituminous sand is so firmly cemented by the viscous oil that excavation is troublesome. At Abasand Oils Ltd quarry, the sand had to be loosened by explosives before excavation by power shovel was feasible. At Bitumount, the power shovel can be used directly without difficulty.

PRESIDENT TO VISIT A.S.T.M.

The President of the Institute has accepted an invitation to attend the meeting of the A.S.T.M. in San Francisco during the week commencing October 10 and to be present at the luncheon of Committee D-2 on October 12.

This invitation is yet another step in the direction of international co-operation in standardization. It is particularly welcome as it follows closely on the visit of A.S.T.M. delegates to Great Britain to discuss questions of measurement standards with our own Institute and with Continental bodies.

During this meeting Committee D-2 (Petroleum Products and Lubricants) has arranged two symposiums, one on high additive content oils and the other on turbine oils.

PERSONAL NOTES

F. Morton, F.Inst.Pet., Member of Council, has been appointed to the second chair of chemical engineering of the University of Birmingham, in place of Dr *Stacey G. Ward*, who was recently appointed to the chair of mining.

L. W. Berry, O.B.E., F.Inst.Pet., and *J. E. Hall* have been appointed director and general manager respectively of Lobitos Oilfields Ltd., in place of the late A. T. Beazley. Also Mr Berry has been made a general manager and Mr Hall a director of Anglo-Ecuadorian Oilfields Ltd.

J. M. Pattinson, C.B.E., A.M.Inst. Pet., has been appointed a deputy director of the Anglo-Iranian Oil Co. Ltd.

A. Morrison, A.M.Inst.Pet., who has recently been appointed general refineries manager in Iran of the Anglo-Iranian Oil Co. Ltd., has spent the whole of his 26 years' service with the Company in Iran.

K. B. Ross, F.Inst.Pet., has been appointed deputy general refineries' manager in Iran of the Anglo-Iranian Oil Co. Ltd. He joined the Company in 1926.

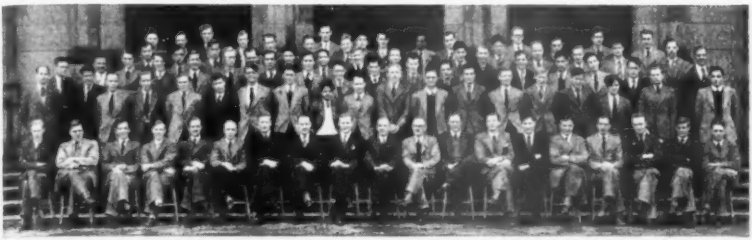
CARBON BLACK PRODUCTION

Carbon black production in the United States during 1948 totalled 1,297,729,000 lb, a reduction of 1·6 per cent from the 1947 figure of 1,318,965 lb. Of the 1948 total, 620,596,000 lb was produced by the furnace process using natural gas or liquid hydrocarbons the remainder being obtained from natural gas by the contact process. The quantity of natural gas used is estimated at 480,646,000,000 cu. ft., the average yield being 2·41 lb/M. cu. ft.

Total sales during 1948 were (in thousand lb) to: rubber companies, 848,075; ink companies, 32,436; paint companies, 6,799 miscellaneous, 45,123.

UNIVERSITY OF BIRMINGHAM CHEMICAL ENGINEERING SOCIETY

President, PROFESSOR F. H. GARNER, O.B.E.



WITH the development of the Birmingham University Oil Department into the present Chemical Engineering Department, the student society also developed from the old Society of Petroleum Technologists, the Birmingham University Student Section of the Institute of Petroleum, into its existing form. Whereas the Student Section merely catered for the academic interests of its members, the Society to-day also concerns itself extensively with social and athletic activities. During the last two years, much enthusiasm has been shown by all concerned and progress has been more than satisfactory.

As part of the Guild of Undergraduates of Birmingham University, the Society has had considerable success in the Inter-Faculty Competitions. In collaboration with the Mining Society, first place was gained in the Winter Games Competition, while in cricket and also in the athletic sports, the combined teams took second places. Among the social activities, the Annual Dances proved very successful and the Society dance is now one of the events of the University Year.

On the academic side, the Society has been very fortunate in having a full programme of lectures on various subjects by eminent and capable speakers. Also, many visits have been made to industry and research stations. Among the more ambitious ones were those made to the Anglo-Iranian Research Station at Sunbury-on-Thames, B.C.U.R.A. at Leatherhead, and the Atomic Research Station at Harwell. On these, as on all occasions, excellent hospitality was enjoyed. It is hoped that invitations will continue to be made by industrial organizations.

The Society as a student body attaches great significance to its relations with industry and the professional institutions, for it appreciates the necessity for good faith and co-operation between all branches of chemical engineering. This is why the Annual Dinner features so prominently in the year's programme. The dinner provides an excellent opportunity of expressing thanks to friends in industry for their help to students. A report on the last dinner appeared in the May issue of the *I.P. Review* for 1949, and it will be remembered that in addition to the President of the Institution of Chemical Engineers and the Presidents of the Institutes of Fuel and of Petroleum, many guests were invited from industry and fellow universities. All those at the dinner welcomed the opportunity of renewing old and making new acquaintances in other sections of the profession.

Another development is the inauguration of the Society's magazine, under the name of "Birmingham University Chemical Engineer", of which the first issue will be published in October. The magazine has been designed with the principal objects of informing industry and other interested bodies of students' activities, and maintaining contact with all those who have been associated with the Chemical Engineering Department of Birmingham University (or the "Oil Engineering Department" as it used to be called). Each issue will contain several reports concerning the Department and the Society and technical and general articles, and in the future will include one or two of the more interesting papers read before the Society by visiting speakers. The magazine is expected to prove very popular and a wide circulation is confidently anticipated.

The change of the name of the Student Section in 1947 and the expansion of its activities has resulted in an even greater interest in the parent institute. Almost all of the 1948–49 final year honours students were Student Members of the Institute. The members are grateful for the interest that has been shown by the Institute of Petroleum in the past, and are very keen to keep and develop the associations with the Institute and the petroleum industry.

The first two paragraphs of the Society's Constitution are:

Name. 1. "*University of Birmingham Chemical Engineering Society and Student Section of the Institute of Petroleum.*"

Objects. 2. "*To enable those interested in Chemical Engineering, Petroleum and Fuels, to meet and correspond, and to promote the study of these subjects. The Society shall also cater for the social and athletic interests of its members.*"

Thus it will be seen that essentially the Society is much as it was in 1925 when it was first formed.

Amongst the members of the Institute are many people who have had associations with the Society. Whether they gave an address, entertained members on a works visit, or helped in any other way, the Society wishes to express its sincere thanks to them for their help, and looks forward to their continued support in the future.

CORRESPONDENCE

To the Editor,
I.P. Review.

DEAR SIR,

Coal Tar Distillation

In the June issue of the *I.P. Review*, under the above heading there appears a summary of an address given by Colonel F. M. Potter, O.B.E., T.D., to the Scottish Branch.

The historical introduction is quite interesting.

Evidently someone has put this historical aspect into a nutshell (or as Colonel Potter remarks in his address: "With the implication that coal tar is an Aladdin's Cave packed with riches") when he composed the following verse which is an extract from *Punch*:

"There's hardly a thing that a man can name,
Of use or beauty in life's small game,
But you can extract in alembic or jar
From the 'physical basis' of black coal-tar
Oil and ointment, and wax and wine,
And the lovely colours called aniline.
You can make anything from salve to a star,
If you only know how from black coal-tar."

Yours truly,
W. Boxall,

15, Dalveen Avenue,
Davyhulme,
Manchester.
August 11, 1949

THE OXFORD OIL EXHIBITION

To celebrate the opening of the new laboratory of the Department of Geology and Mineralogy at Oxford on July 7, an exhibition of oilfield development was held in the new building during July. The exhibition also coincided with the meetings in Oxford of the Fourth Empire Mining and Metallurgical Congress, at which papers were read on "Modern drilling and production practice in the oilfields of South Iran", by H. W. Lane, O.B.E. (*Anglo-Iranian Oil Co.*) and on "The application of auger and core drilling in petroleum exploration", by N. J. M. Taverne (*Shell Petroleum Co.*).

The object of the exhibition was to focus attention on British and Commonwealth enterprise in the development of world oil resources. To this end stress was laid on operations in such areas as Trinidad, Canada, Borneo, India, etc., with photographs, geological maps, and various data. Similarly, in another part of the building, interesting details and views of oilfields in the Middle East were on view.

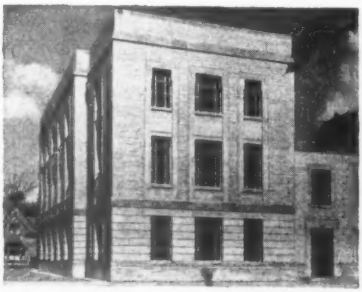
Exploration and drilling were the subject of very instructive displays. Thus, the air survey panels presented photographs and maps showing how geological and geographical features are clearly seen by the eye of the aerial camera. In the geophysics section there were a number of instruments and models on show and some excellent charts illustrating the principles used in the determination of underground structures. There were also diagrams of the various other methods of locating oil structures.

Drilling and production techniques were shown by models and in some cases actual pieces of equipment, and an electrically driven pumping unit was in motion outside the building.

On the refining and utilization sides of the industry a full range of products was on view, the samples being used (1) to show in a diagram the stage at which they were produced, and (2) by the aid of photographs, the purpose for which they were used.

There were three daily showings of petroleum films by the Petroleum Films Bureau. Petroleum publications and periodicals were attractively displayed and leaflets issued by the Petroleum Information Bureau and other bodies were available for those seeking further information.

It is hoped that it will be possible for the exhibition to be permanently located in London.



The new laboratory of the Department of Geology and Mineralogy at Oxford University, which was opened by the Vice-Chancellor of the University on July 7, 1949, was rendered possible by a gift of £25,000 which the Shell Petroleum Co. Ltd. made in 1937.

SAVED BY A TANKER

East London, a coastal city of 77,000 population, over 250 miles from Durban, South Africa, is being saved from drought by the transport of 40,000,000 gal of fresh water in a new oil tanker, the *Athel Crown*. The tanker was diverted from service in the Persian Gulf. The first cargo of 3,500,000 gal reached East London at the end of July from Durban.

PETROLEUM IN PARLIAMENT

Departmental Consumption

Replying to a written question on July 7, the Financial Secretary to the Treasury said that a total of £5,623,430 was spent by Government Departments on petrol during the year ending March 31, 1949. Of this sum £2,367,670 represented Customs duty.

On July 25 the Minister of Fuel and Power, in an oral answer, gave the total consumption of petrol by Government Departments as:

—	1945	1946	1947	1948
	Tons	*Tons*	*Tons*	*Tons*
Private Cars	38,092	33,152	31,523	32,572
Other than Private Cars	60,755	64,011	79,904	88,333
Total	98,847	97,203	111,427	120,905

He said that the amount of petrol consumed in private cars between 1945 and 1948 decreased as a result of various measures of economy. On the other hand, the amount used in commercial and similar vehicles increased during the same period by 27,000 tons. This was due chiefly to the restoration of their pre-war services by the Post Office, and to special building operations undertaken by the Ministry of Works.

The Postmaster-General, in a written answer on July 29, gave the annual consumption of petrol by vehicles of the G.P.O. as:

	Gallons
1945–46	9,745,245
1946–47	12,007,823
1947–48	12,993,035
1948–49	13,712,696

These figures include a small proportion of heavy fuel oil.

Fuel Taxation

The Chancellor of the Exchequer was asked on July 7 whether, in view of the increasing demands for, and growing shortage of, kerosine, the progress being made with the construction of new oil refineries in the U.K. and other developments in this connexion, he would consider the desirability of setting up an expert inquiry to review the whole field of fuel taxation.

The Financial Secretary replied that the matter was kept under constant review and the Chancellor saw no need for a special inquiry at present.

German Synthetic Oil Plants

The Under-Secretary of State for Foreign Affairs said (July 11) that 11 licences for repair work had been issued at different times between 1945 and 1948 to six out of the ten synthetic oil plants in western Germany. In the case of five of the plants, licences were for partial re-activation; in the sixth case the licence was for maintenance only. Military Government was always aware that these plants were liable to be dismantled. This was made clear to the Germans whenever licences were issued.

In one case only, that of Krupp Triebstoffewerke, which belonged to a group of collieries, an estimate amounting to RM 3 million was approved.

Answering a further question, the Under-Secretary said this expenditure was not sanctioned for the production of oil from coal; it was for the partial re-activization of other products.

The Chancellor of the Exchequer (July 12) said that no dollars would be saved to the sterling area if the German synthetic oil plants were worked to capacity instead of being dismantled, and the output either sold in dollar territories or used to save dollar purchases.

Iraq Pipeline

H.M. Ambassador at Baghdad has made representations to the Iraqi Government on more than one occasion during the past six months with regard to the resumption of supplies of crude oil through the pipeline to Haifa, said

the Under-Secretary of State for Foreign Affairs (July 11). Representations were continuing.

Haifa Refinery

Answering a written question on July 12 the Parliamentary Secretary to the Minister of Fuel and Power said there had been no direct loss of dollar revenue from oil sales as a result of the closing down of the Haifa refinery. With the refinery operating there might have been some saving in dollar expenditure on oil, which it was not possible to evaluate.

Petrol Consumption

The Minister of Fuel & Power said, on July 28, that for 1948 it might be estimated that 1·4 million tons of petrol were consumed by private motorists, 1·7 million tons by goods vehicles, and 0·2 million tons by public service vehicles.

IS A DIP ROD A "MEASURE"?

This interesting question recently came under consideration by the Court of Appeal during the hearing of the case of *Eric Gnapp, Ltd.*, v. *Petroleum Board* ([1949] 1 All E. R. 980). The plaintiffs were garage proprietors who purchased petrol from the defendants, the petrol being delivered by the suppliers in the usual manner by a tank wagon, measurement of the contents of which was made by a dip rod calibrated for use with the wagon. A dispute between the buyers and sellers arose regarding the accuracy of the deliveries made, the buyers alleging short delivery. It was, in fact, found that the dip rod used for measurement was erroneous and an allowance for the amount of short measure was made, the sellers having admitted that deficiencies (to the extent of one gallon per delivery of about 300 gallons) had occurred.

The buyers alleged that the deficiencies were greater than were admitted by the suppliers and brought an action to recover the amount stated to have been overpaid by them. The conditions of sale laid down by the suppliers included the following clause: "The buyers shall accept as having been discharged from the seller's road tank wagon such quantity shown by the seller's road tank wagon dip rod in connexion with deliveries of motor spirit". The plaintiffs, however, contended that, since the dip rod had been admitted to be erroneous, the contract was avoided by virtue of the Weights and Measures Act, 1878, s.25 (as amended by the act of 1889, s.3) whereby it is stated that:

"Every person who uses or has in his possession for use for trade any weight, measure, scale, balance, . . . which is false or unjust . . . and any contract, bargain, sale or dealing made by the same shall be void . . ."

Furthermore, by s.29 of the 1878 Act, a contract is also avoided if made by a measure which is not stamped as required by that section. If the tank wagon or dip rod or the two in combination could be held to be a "measure" then the above-mentioned sections of the Act would apply if the "measure" were defective and also the "measure" could be confiscated and the user thereof subjected to penal sanctions. If, however, the dip rod, either alone or in combination with the tank-wagon were a "measuring instrument" the Act would not apply and the sale would be governed by the contract made between the two parties. It should be noted that whilst there is a specific enactment dealing with "measuring instruments" used for the sale of fuels and lubricants (The Measuring Instruments (Liquid Fuel

and Lubricating Oil) Regulations, 1929, (S.R. & O. No. 183 of 1929)) these regulations are limited to the sale in individual quantities of amounts not exceeding 20 gallons and hence would not govern the case under consideration.

After an exhaustive and interesting consideration of the application and meaning of the term "measure" the court unanimously decided that the dip rod was a "measuring instrument" and not a "measure" and it was held that the buyer was bound by the condition of sale mentioned on page 277, the appeal being, therefore, dismissed. The impracticability of stamping a dip rod which is only applicable to a particular container or containers, was one of the factors leading the court to this decision.

A point which does not appear to have been argued before the court is that an inaccuracy of 1 gallon in 300 might be considered as being insufficient to bring the dip rod, even if this had been held to be a "measure", within the scope of being "false or unjust" as this proportion is very close to the deficiency of 1 part in 320 which is the most stringent standard set by the 1929 regulations (mentioned above) for measuring instruments dealing with sales of quantities of less than 20 gallons.

A further point considered in the appeal was that during the dispute between the plaintiffs and the defendants the latter at one stage refused to deliver further quantities of petrol to the plaintiffs unless certain allegations which they (the plaintiffs) had made regarding the defendants trading methods were withdrawn. Such withdrawal was not made, with the consequence that the garage company was unable to obtain further supplies of petrol whilst the supply of this commodity was under the exclusive control of the Petroleum Board. It was argued on behalf of the plaintiffs that when a trader is forced by a statutory enactment to obtain his supplies from a source having the monopoly of the sale of the particular commodity in question a refusal on the part of such monopoly to supply the trader gives the latter a cause of action.

After examination by the court of the Order (The Control of Petroleum Order, 1944 (S. R. & O. No. 171 of 1944)) which, at the time, gave the suppliers the monopoly of the supply of petrol it was held that the terms of this Order were not such as to place any obligation to supply on the Petroleum Board or to make failure to supply an offence.

However, the growth of monopoly trading makes this point of more than academic interest and the following remarks of Tucker, L. J. (at p. 985 of the report) deserve to be borne in mind: "This kind of question may some day in a proper case require careful consideration. With the growth of statutory corporations to which monopolies are given by the statutes creating them, it may become of supreme importance to decide, on the construction of the relevant statute, to what extent, if any, a refusal by the statutory body to do business with a particular trader may afford that trader a right of action."

V. B.

LAST SHIPMENT OF M.E. CRUDE TO U.S.A.

The last shipment of Middle East crude to be imported into the U.S.A. reached New York on August 3 in the tanker *Apache Canyon*. This cargo was about 110,000 brl of Kuwait crude purchased from Anglo-Iranian Oil Co. Ltd., and completed a contract made early in 1948 by Standard Oil Co. (New Jersey). The company has no present plans for any further importation of Middle East crude.

A.S.T.M. ANNUAL MEETING

At the 52nd Annual Meeting of the A.S.T.M. held in Atlantic City, June 27 to July 1, upwards of 185 papers and reports were presented at 22 formal technical sessions and several informal sessions and discussions.

In its report Committee D-2, on Petroleum Products and Lubricants, recommended that the following proposed methods be published as information:

Micro Cone Penetration of Lubricating Greases.
Apparent Viscosity of Lubricating Greases.
Definitions, Functions, Types, and Designations of Cutting Fluids.
Carburettor Jacket for use with Motor and Research Methods to Rate High Vapour Pressure Fuels.
Colour Index of Petroleum Products by Photoelectric Colorimeter.
Sulphur in Petroleum Products by the CO_2-O_2 Lamp Method with Supplement.

The following methods of test are recommended for publication as tentative:

Acetylene in Polymerization Grade Butadiene by Silver Nitrate Method.
Oxygen in Butadiene Vapours by Manganous Hydroxide Method.
Peroxides in Butadiene by Ferrous Titanous Method.
Separation of Residue from Butadiene.
Butadiene Dimer in Polymerization Grade Butadiene.
Non-volatile Residue of Polymerization Grade Butadiene.
Sodium in Lubricating Oils and Lubricating Oil Additives.
Measurement of Freezing Points for Evaluation of Purity.
Determination of Purity from Freezing Points.
Total Olefinic and Aromatic Hydrocarbons in Gasoline.
Hydrogen in Petroleum Fractions by the Lamp Method.
Benzene and Toluene by Ultraviolet Spectrophotometry.

Several tentative methods have been revised and a number recommended for advance to standard.

Several tentative methods of interest are recommended by Committee D-1 on Paint, Varnish, Lacquer, and Related Products. They are:

Bituminous Emulsions Intended for Use as Protective Coatings for Metals.
Aniline Point and Mixed Aniline Point of Hydrocarbon Solvents.
Heptane Number of Hydrocarbon Solvents.
Kauri-Butanol Number of Hydrocarbon Solvents.

"PETROLEUM TIMES" JUBILEE

On February 18, 1899, the first issue of *Petroleum Times* (then called *The Petroleum Industrial and Technical Review*) made its appearance and the Silver Jubilee of this, the oldest petroleum periodical in the world, is celebrated in a special 178-page issue dated June 17.

In this issue the editor, Cecil W. Wood, has brought out the highlights of the petroleum industry of Great Britain in an extremely fascinating and readable manner. He has divided the half-century into ten five-year periods in which he has picked out points which indicate the general trend of events and thought in the industry. The reader is not over-burdened with masses of statistics, but throughout there are some excellent graphs which show clearly how imports fluctuated, the changes in the sources of these imports, the run of prices of petroleum products, and similar information.

There are also many excellent illustrations and some records of the part played by individual companies in the development of the British petroleum industry.

Petroleum Times Jublilee Number is in effect a summary of the history of the British petroleum industry and we congratulate the editor on producing a tome of absorbing interest. We also congratulate the publishers on their making such a record possible and wish the journal continued success.

Copies are available from the publishers at Brettenham House, Lancaster Place, London, W.C.2, price 10*s*.

FILMS

The latest list of the Petroleum Films Bureau includes particulars of over 70 films which are available on loan, free of charge, to any responsible organization. The list is impressive and the interest widespread. Thus, under the heading of General Interest, we find listed films as diverse as *The Cornish Engine*, and *The Microscope*. As is to be expected, the films included under "Films about Petroleum" cover the industry from exploration to refining. In the group on "Aviation, Motor Cars, etc.," there is a series of six films on *How an Aeroplane Flies*, and several on internal combustion engines, their accessories, and their lubrication.

Finally, there are four special films on "Road Safety". While the titles, e.g., *The Puddle Muddle Riddle* and *The Ballad of the Battered Bicycle*, suggest that they are primarily for the children, there is no doubt that adults should benefit from seeing them.

The films generally are on non-flammable stock and generally are 35 mm and 16 mm, mostly sound but a few silent. Details are available from the Bureau at 29 New Bond Street, London, W.1.

Industrial Films

Aims of Industry Ltd. have just issued a 65-page list of 16-mm industrial films which are available for loan free of charge. These films, which cover a very wide field from agriculture to sea transport and from mining to plastics, have been made available through the co-operation of various organizations and film libraries, including the Anglo-Iranian Oil Co. Ltd., Shell Petroleum Co. Ltd., the Petroleum Films Bureau, Imperial Chemical Industries Ltd., etc.

Details are obtainable from the Films Bureau, Public Relations Division, Aims of Industry Ltd., 12 Carteret Street, London, S.W.1.

U.K. PETROLEUM TRADE IN FIRST HALF OF 1949

By GEORGE SELL (Fellow)

Total imports into the U.K. of crude petroleum and refined products during the first half of 1949 were, according to the official return,* 2,452,702,000 gallons, a slight increase over the figure for the preceding half-year and 11 per cent higher than in the same period of last year.

Crude oil imported during the first six months of 1949 amounted to 716,412,000 gal, an increase of 3·7 per cent over the preceding six months and 48 per cent higher than in the first six months of 1948.

As will be seen from Table I, comparing the figures for the two last six-month periods, motor spirit, kerosine, and gas oil showed increases of 10·3, 13·0, and 14·1 per cent respectively. However, total imports of refined products were 1·2 per cent lower, this decrease being accounted for in the main by a 23·7 per cent reduction in the imports of fuel and diesel oils.

*"Accounts relating to trade and navigation of the United Kingdom, June, 1949."

TABLE I

QUANTITY AND VALUE OF U.K. PETROLEUM IMPORTS

	January to June 1949		July to December 1948		January to June 1948	
	Quantity 1000 *gal.*	*Value* £	*Quantity* 1000 *gal*	*Value* £	*Quantity* 1000 *gal*	*Value* £
Crude petroleum	716,412	17,767,278	690,664	18,225,643	483,999	12,854,317
Motor spirit	719,565	27,404,330	652,284	25,596,500	541,659	21,522,261
Other spirit	15,383	645,993	17,464	791,020	12,654	598,792
Kerosine	234,900	8,168,972	207,953	7,602,555	200,446	7,425,694
Lubricating oil	38,976	2,858,861	39,971	3,597,255	46,448	4,268,387
Gas oil	263,485	8,338,481	230,895	8,517,245	245,573	8,864,165
Fuel and diesel oils	463,936	10,054,686	608,034	14,785,007	695,559	20,762,077
Other sorts	45	10,881	37	12,764	41	17,170
Total refined products	1,736,290	£57,482,204	1,756,638	£60,902,346	1,742,380	£63,458,546
GRAND TOTAL	2,452,702	£75,249,482	2,447,302	£79,127,989	2,226,379	£76,312,863
	Cwt		*Cwt*		*Cwt*	
Paraffin wax	181,229	497,475	231,433	744,753	488,857	1,569,432
Mineral jelly	81,920	160,634	72,201	110,600	123,172	217,741
Carbon black from natural gas	285,586	903,539	418,515	1,308,949	456,300	1,391,171
	Tons		*Tons*		*Tons*	
Natural asphalt and bitumen	27,837	271,028	21,036	208,450	23,594	240,429

In the case of solid products, both paraffin wax and carbon black from natural gas showed considerable reductions in their imports. There were slight increases for mineral jelly and for natural asphalt.

In Table II the imports of refined products are expressed as percentages of the total, and it is of interest to note general trends. Thus, in the last three six-month periods there has been a tendency for the proportions of motor spirit, kerosine, and gas oil to increase, this corresponding with a declining tendency for the item fuel and diesel oils.

TABLE II

PERCENTAGE IMPORTS OF PETROLEUM PRODUCTS

	Jan-June 1949	*July-Dec* 1948	*Jan-June* 1948
	Per cent		
Motor spirit	41·4	37·1	31·0
Other spirit	0·9	1·0	0·8
Kerosine	13·5	11·8	11·5
Lubricating oil	2·3	2·3	2·7
Gas oil	15·2	13·2	14·1
Fuel and diesel oils	26·7	34·6	39·9
	100·0	100·0	100·0

AVERAGE VALUES

Although crude oil imports in the first half of 1949 were higher in quantity than in the last half of 1948, their cost, including insurance and freight, was 2·5 per cent lower.

In Table III, the import values of all

TABLE III

AVERAGE UNIT VALUES OF U.K. PETROLEUM IMPORTS

	Jan-June 1949	*July-Dec* 1948	*Jan-June* 1948
	£ *per* 1000 *gal*		
Crude petroleum	24·80	26·39	26·54
Motor spirit	38·08	39·24	39·73
Other spirit	41·99	45·24	47·32
Kerosine	34·78	36·56	36·55
Lubricating oil	73·35	90·00	91·96
Gas oil	31·65	36·89	36·09
Fuel and diesel oils	21·67	24·32	29·85
Other sorts	241·80	345·00	418·78
Total refined products	33·11	34·67	36·42
	£ *per cwt*		
Paraffin wax	2·74	3·23	3·21
Mineral jelly	1·96	1·55	1·72
Carbon black	3·16	3·13	3·05
	£ *per ton*		
Natural asphalt and bitumen	9·74	9·91	10·19

petroleum imports, have been calculated on a unit basis. From this it is seen that average values were, with the exception of mineral jelly and carbon black, lower than in the preceding half-year. The largest decrease in unit value was for lubricating oil, which dropped by 19·5 per cent.

Consigning Countries

Such details as are available from the present return in regard to countries of consignment have been tabulated in Table IV, but it must be stressed that the "consigning" country is not always the country of origin of the goods imported.

TABLE IV

COUNTRIES CONSIGNING PETROLEUM TO THE U.K.

Country and Product	*Jan-June 1949*	*July-Dec 1948*	*Jan-June 1948*
	Thousand gallons		
British West Indies:			
Motor spirit	40,355	45,654	44,031
Kerosine	24,604	16,680	29,203
Gas oil	11,131	(a)	10,147
Fuel & diesel oils	44,812	33,727	36,805
	120,902	96,061	120,186
Bahrein, Kuwait, Quatar, & Trucial Oman			
Crude petroleum	214,509	112,917	44,056
Motor spirit	30,115	7,390	13,738
Kerosine	5,059	8,575	10,990
	249,683	128,882	68,784
Palestine:			
Motor spirit	—	—	13,599
Other British Countries:			
Crude petroleum	—	—	23,133
Motor spirit	13	—	73
Kerosine	—	—	—
Lubricating oil	38	64	14
Gas oil	15,974	27,633	11,832
Fuel & diesel oils	5,032	7,532	9,053
	21,057	35,229	44,105
Netherlands West Indies:			
Crude petroleum	103,668	141,072	136,793
Motor spirit	239,859	261,868	243,260
Kerosine	124,716	106,635	99,262
Lubricating oil	4,212	3,796	3,508
Gas oil	65,318	43,811	69,652
Fuel & diesel oils	128,647	296,444	425,567
	666,420	853,626	978,042

TABLE IV (*contd.*)

Country and Product	*Jan-June 1949*	*July-Dec. 1948*	*Jan-June 1948*
	Thousand gallons		
Iran:			
Crude petroleum	157,667	135,786	111,600
Motor spirit	113,649	136,835	77,585
Kerosine	65,060	75,573	59,223
Gas oil	21,453	43,198	56,143
Fuel & diesel oils	237,636	227,229	197,848
	595,465	618,621	502,399
United States:			
Crude petroleum	6,526	4,237	12,251
Motor spirit	233,336	164,464	119,802
Kerosine	4,973	162	1,768
Lubricating oil	34,698	36,111	42,913
Gas oil	74,078	77,608	79,917
Fuel & diesel oils	2	4,271	7,566
	353,613	286,853	264,217
Saudi Arabia:			
Crude petroleum	121,753	108,514	68,386
Gas oil	12,060	—	—
Fuel & diesel oils	—	(b)	3,600
	133,813	108,514	71,986
Venezuela:			
Crude petroleum	37,762	38,793	19,420
Motor spirit	6,370	8,895	8,323
Gas oil	9,109	9,980	3,787
Fuel & diesel oils	26,961	7,117	2,376
	80,202	64,785	33,906
Iraq:			
Crude petroleum	60,857	104,383	40,830
Mexico:			
Gas oil	18,984	(b)	14,000
Peru:			
Crude petroleum	13,666	23,917	16,146
Canary Islands:			
Fuel & diesel oils	528	(b)	3,636
Roumania:			
Motor spirit	—	—	7,228
Soviet Union:			
Motor spirit	—	3,467	5,706
Other Foreign Countries:			
Crude petroleum	4	21,077	11,384
Motor spirit	55,868	31,125	8,314
Kerosine	10,488	328	—
Lubricating oil	28	—	13
Gas oil	35,378	52,812	95
Fuel & diesel oils	20,318	38,950	9,108
	122,084	144,292	28,914

(a) Included in "Other British".
(b) Included in "Other foreign".

In regard to the countries coming under the designation of "British" in the official return, the most interesting is group Bahrein, Kuwait, Quatar, and

Trucial Oman. Here there are very large increases in the provision of crude petroleum and of motor spirit, although kerosine appears to be decreasing steadily.

In the case of foreign countries, the Netherlands West Indies still maintains its position as the largest consignor, with Iran a close second. There are still far too many countries hidden under the entries for "Foreign countries", and this is particularly so in relation to the periods January to July, 1949, and July to December, 1948. Similar remarks apply to the item "Other British".

Re-exports

A comparatively small quantity of imported oils are re-exported from the U.K. and details of these re-exports for the three six-month periods are given in Table V.

The same table also records the quantities of oil fuel shipped for the use of steamers (including fishing vessels) engaged in the foreign trade.

TABLE V

U.K. RE-EXPORTS OF IMPORTED PETROLEUM

	Jan-June 1949	*July-Dec 1948*	*Jan-June 1948*
	Thousand gallons		
Motor spirit	7,098	8,038	5,153
Kerosine	2,288	1,093	1,011
Lubricating oil	782	838	798
Fuel & diesel oils	2,515	4,526	17,334
All other sorts	3,119	1,756	953
Total	15,802	16,251	25,249
Value	£661,102	£746,659	£931,713
Oil fuel for use in steamers	222,723	213,780	254,268

Home Products Exported

There was a noteworthy increase of approximately 50 per cent in the export of oils produced and manufactured in the U.K. during the first half of 1949 in comparison with the second half of the previous year. It would appear that all products shared in this increase, details of which are in Table VI. It is noted however, that official details tend to become less and less, as the entry "all other oils" now includes fuel and diesel oils.

In spite of the large increase in quantity, the corresponding value was only 6 per cent higher. Unit values in £ per 1000 gal were: motor spirit, £3973. (*£44·56 in second half of 1948*); lubricating oil, £161·13 (*£170·02*); gas oil, £34·42 (*£38·62*); all other sorts, £34·08 (*£43·46*).

TABLE VI

U.K. EXPORTS OF HOME-PRODUCED AND MANUFACTURED PETROLEUM

	January to June 1949		July to December 1948		January to June 1948	
	Quantity 1000 gal	*Value £*	*Quantity 1000 gal*	*Value £*	*Quantity 1000 gal*	*Value £*
Motor spirit	9,833	390,688	3,700	164,876	2,262	109,917
Lubricating oil	14,338	2,310,292	14,741	2,508,573	13,215	2,017,909
Gas oil	4,109	141,433	2,147	82,912	2,099	70,853
All other sorts	11,240	383,040	6,355	286,344	1,477	109,750
TOTAL	39,520	£3,225,453	26,943	£3,042,705	19,053	£2,308,429
	Cwt		*Cwt*		*Cwt*	
Lubricating compounds	76,195	234,339	74,767	232,571	57,227	202,875
Paraffin wax	1,959	12,008	21,416	82,559	31,677	126,235
	Tons		*Tons*		*Tons*	
Manufactured bituminous asphalts and emulsions	31,092	425,586	36,139	461,864	37,926	489,335

FORTHCOMING MEETINGS

INSTITUTE MEETINGS

Bitumen Horizons. A. W. Jarman. At 26 Portland Place, London, W.1, 5.30 p.m. (tea 5 p.m.) October 12.

Synthesis and Properties of Hydrocarbons. Hydrocarbon Synthesis Panel of Research Group. At 26 Portland Place, London, W.1. (tea 5 p.m.) November 9.

SCOTTISH BRANCH

Domestic Heating. E. A. C. Chamberlain. At North British Station Hotel, Edinburgh, 7.30 p.m., October 5.

STANLOW BRANCH

Bitumen Horizons. A. W. Jarman. At Grosvenor Hotel, Chester, 7.15 p.m., November 16.

MEETINGS OF OTHER SOCIETIES

Electronics Symposium. The Scientific Instrument Manufacturers Association. At Examination Hall, Queen's Square, London W.C.1., 2.30 p.m., November 2; 10 a.m. and 2.30 p.m., November 3; 10 a.m. November 4.

Chemical Works Safety Conference. Association of British Chemical Manufacturers. At Royal Hotel, Scarborough 8.30 p.m., October 7; 10 a.m. and 8 p.m. October 8; 9.30 a.m. October 9.

NORTHERN BRANCH

Officers of the Northern Branch for 1949-50 are T. W. Ranson, chairman; G. M. Davies, hon. secretary; E. R. Wilson, hon. treasurer.

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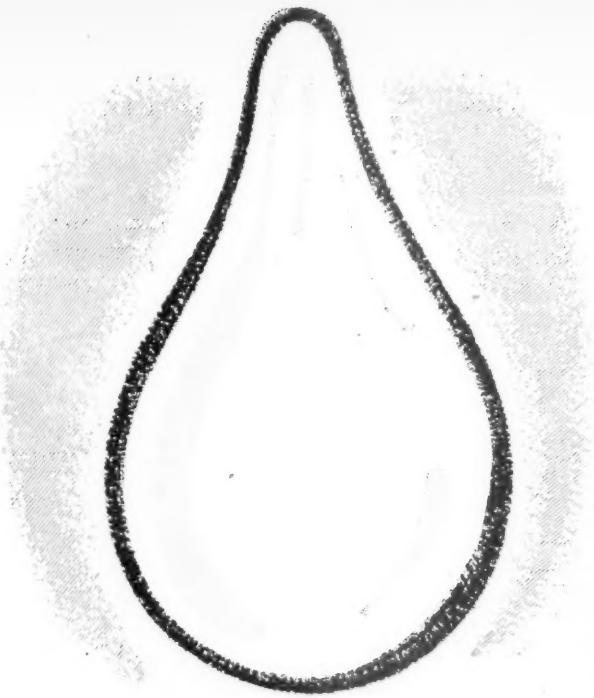

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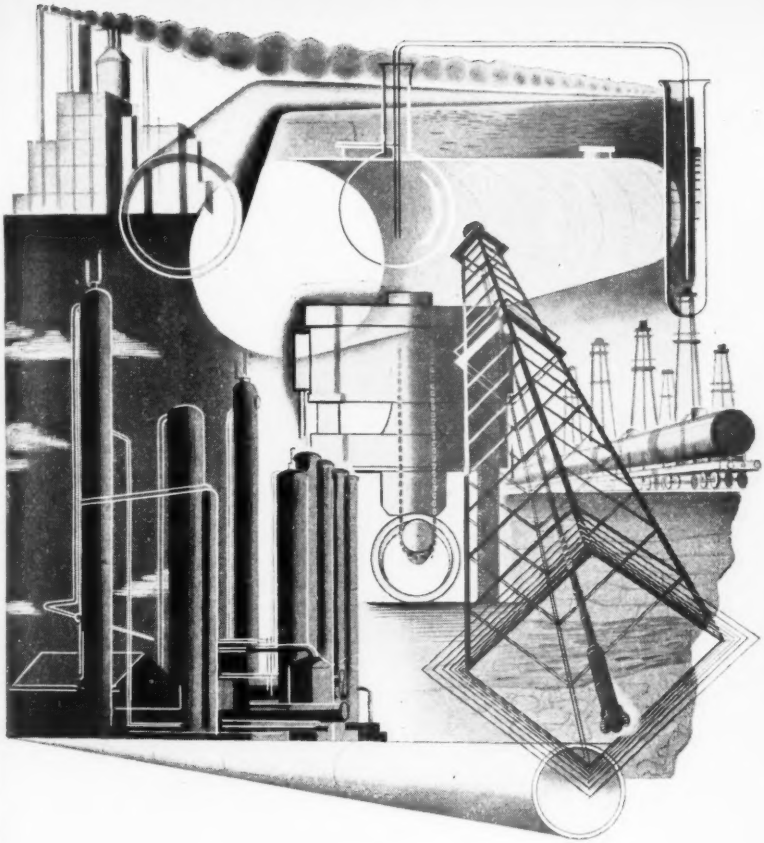

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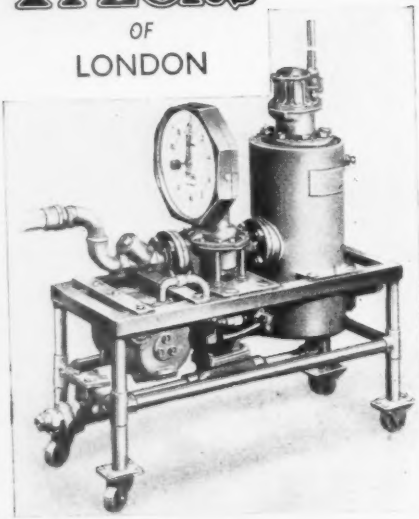

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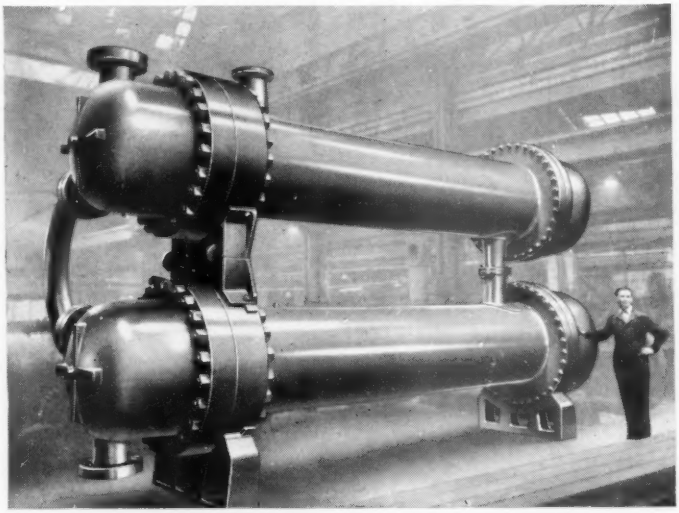

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These two Units form part of a battery comprising 60 similar Units and having a Crude Oil throughput of 4½ million gallons per day.

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